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DETERMINATION OF REQUIRED PACK WIDTH FOR A MONOLITHIC PACK INSTALLATION IN THE 9E COAL ROAD, LINGAN COLLIERY

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DETERMINATION OF REQUIRED PACK WIDTH FOR A MONOLITHIC PACK INSTALLATION IN THE 9E COAL ROAD, LINGAN COLLIERY

by

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ABSTRACT

The decision of the Cape Breton Development Corporation (CBDC) to implement a monolithic pumped packing trial in the 9E coal road at Lingan Colliery necessitated careful consideration of the pack width required to maintain the gateroad. This report describes the procedure used to recommend a 2.1 m pack width for that trial.

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DÉTERMINATION DE LA LARGEUR DU MUR DE REMBLAI EN VUE DE L'AMÉNAGEMENT D'UN REMBLAI MONOLITHIQUE DANS LA GALERIE 9 DE LA HOUILLÈRE LINGAN

par

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RÉSUMÉ

En raison de la décision de la Société de développement du Cap-Breton (SDCB) d'installer, à titre d'essai, un remblai monolithique dans la galerie de charbon 9E de la houillère Lingan, on a dû apporter beaucoup d'attention à la sélection de la largeur du mur de remblai qui est appelé à soutenir la galerie. Le présent rapport porte sur les méthodes que l'on a utilisées et qui ont permis de recommander un remblai d'une largeur de 2,1 m pour l'essai.

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INTRODUCTION

The decision by CBDC to install and monitor a trial of monolithic pumped packing to try to control the problem of gob leakage represents a major advance in mining technology in the Sydney Coalfield.

With minimal experience of pumped packing, (a short trial using 'Aquapack' was conducted in the 3W coal road in 1982) CBDC asked CBCRL for assistance in selecting the pack width required to maintain gateroad stability.

The results of gateroad monitoring in the 8E coal road and in situ stress/strain properties of a monolithic packing material similar to that intended for the 9E trial were used to estimate the support resistance that would be offered by packs of various widths. The pack width ultimately recommended (2.1 m) was based on these results, the layout of the 9E coal road face-end and anticipated differences in the physical properties of the packing system to be used and those of the material used for the calculations.

CALCULATION OF PACK WIDTH

Results from instrumentation sites in the 8E coal road indicate pack loads of 4.5 - 5.5 MN/m^2 after 27% pack strain. This occurs after 100 m of face advance, after which time pack loads and rate of closure stabilise. A pack strain of 27%, when analysed in conjunction with closure results from other stations in the roadway, reflects a tilt of the overlying roof strata of approximately 3°. This represents the limit of gateroad stability. Further deflection of the roof beam will result in major roof breaks and deterioration of the roadway. The value of 3° has been found to be applicable in a wide variety of coal mining conditions. Ideally, the monolithic pack will restrict roof beam tilt to 3° or less by offering the same resistance as the existing pack.

The support resistance offered by the conventional pack can be expressed in MN/m length of roadway by dividing the pack load by the pack width. Thus the support required from the new packing system is 6.75 - 8.25 MN/m.

A value for the support offered by a monolithic pack can be deduced by examining its in situ stress/strain characteristics. Unfortunately field data for 'Astrapack', the proprietary blend chosen by CBDC for the trial, was not available, so data from in situ monitoring of 'Aquapack', a similar material used at Hem Heath Colliery in Great Britain was used (Figure 1). The data illustrates the in situ stress/strain characteristics of 'Aquapack' mixes of varying cement composition, expressed as a percentage cement by weight. Curve 3 is the ideal - 14% cement.

Extrapolating curve 3 to 27% strain and multiplying the expected stress by the pack width of 1.5 m gives a theoretical support resistance of 8.25 MN/m. Monolithic packs of 1.82 m, 2.13 and 3 m width will achieve the same support resistance after 24%, 22% and 19% closure, respectively.

Thus the calculation indicates that an 'Aquapack' pumped pack of 1.5 m width would provide the required support. There are, however, several reasons why a wider pack should be considered.

1. 'Astrapack', the material chosen for the trial, has a lower solids content than 'Aquapack', the material on which the calculations are based. The in situ stress/strain characteristics of 'Astrapack' can be reasonably expected to be inferior to those of 'Aquapack'.
2. Low solids cement based packing systems are extremely sensitive to variations in component concentration (Figure 1). To ensure the success of the trial in the early stages it would be prudent to include a safety factor in the pack width.
3. Cement curing time and strength development is temperature sensitive. Low ambient temperatures which might occur during winter months have been the cause of slow strength development elsewhere.

The recommended pack width, therefore should be greater than 1.5 m. The face-end layout in the 9E coal road will conveniently allow a pack width of 2.1 m without major changes of the powered supports. This width was therefore recommended, together with a programme of gateroad monitoring to allow the behaviour of the packs to be determined, and if necessary changed.

CONCLUSIONS

In situ observations have been used to derive a recommended pack width for a pumped packing trial in the 9E coal road at Lingan Colliery. The trial will be monitored to ensure that the support offered is adequate and to optimise packing costs.

KEY

I "Aquapack" 5% cement by weight
2 do. I0% do.
3 do. I4% do.
4 I.5m x I.5m 80% solid Hardwood Chock

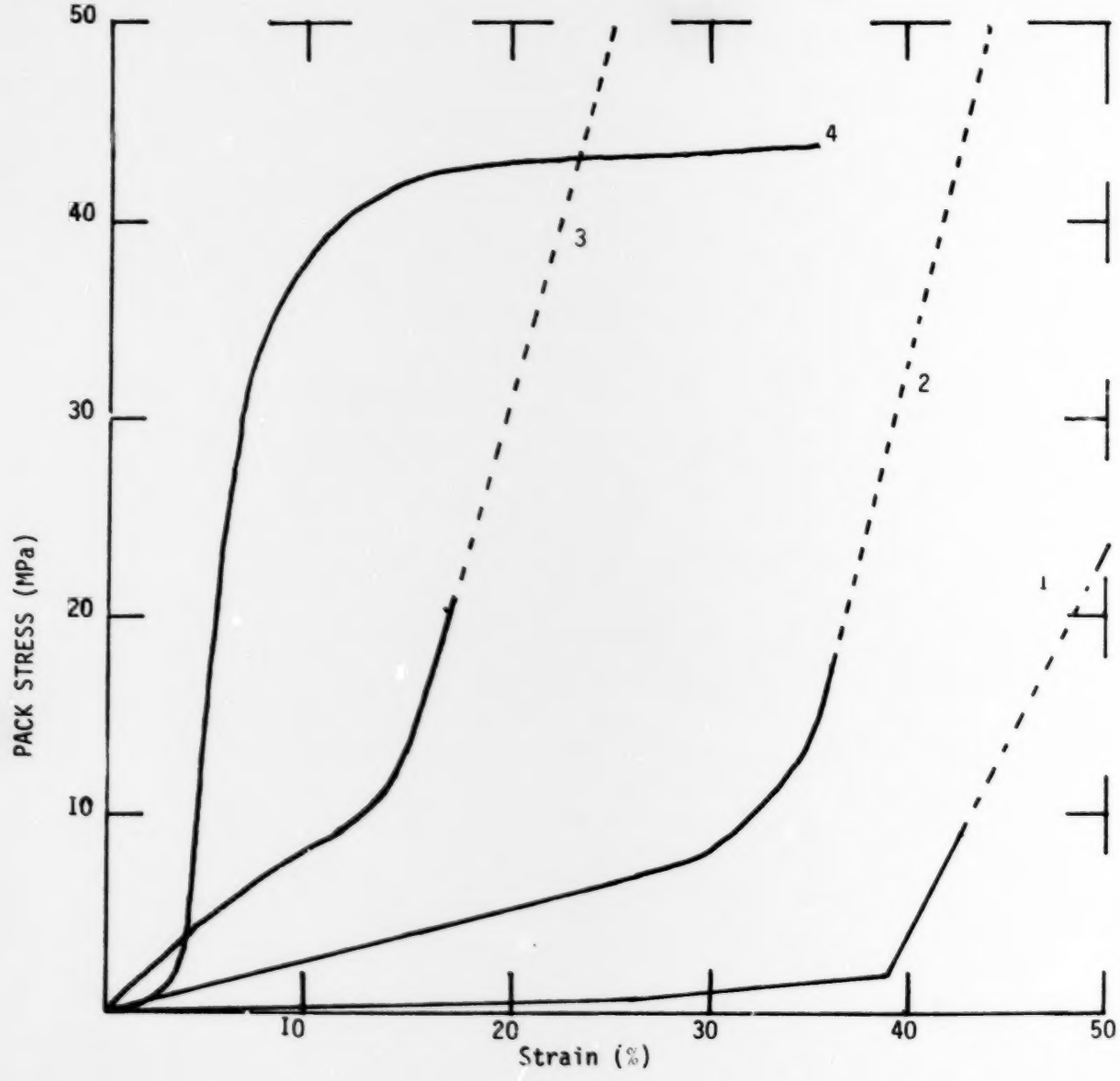

Figure 1 - Stress/strain curves for 'Aquapack' and a hardwood chock